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1.0 Purpose & Scope

This document describes the SHSD Industrial Hygiene Group (IHG) response action to personal concerns for Indoor Air Quality (IAQ), Building Related Illness (BRI), and Sick Building Syndrome (SBS) at BNL facilities. It provides standards of performance for setting up investigation teams, sampling for hazards when appropriate, and preparing plans for corrective actions when appropriate. Its purpose is to establish a policy to:

- Ensure development of high quality investigations,
- Define targeted solutions to identified causes, and
- Ensure rapid dissemination of information to appropriate groups who have a role in responses and corrective actions.

The goal of the procedure is to provide a uniform protocol for acting on and documenting hazard analyses assessing personnel exposure to IAQ, BRI, and SBS concerns. Indoor Air Quality investigations typically involve multi-organization involvement to obtain satisfactory resolution. To facilitate a coordinated response, the following procedure, with its Action Plan, can be used as a guideline for response actions. Appended to this procedure are *Record* forms that may be used to document many aspects of the response.

This procedure is primarily designed for large scale IAQ issues. Minor or easily identified/rectified issues may be resolved at a more local level with selected documentation or application of only portions of this procedure.

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2.0 Responsibilities

- 2.1 **Program Administration:** This procedure is administered through the SHSD Industrial Hygiene Group. Members of the SHSD Industrial Hygiene Group are required to follow this procedure.
- 2.2 Other BNL organizations that provide BNL with field monitoring and hazard assessment services should follow this SOP to ensure an equal or superior method of assessment, documentation and recordkeeping.

3.0 Definitions

Building Related Illness a term used to describe diagnosable illness which can be directly related to airborne building contaminants. Building occupant complains of symptoms, the symptoms can be clinically defined and have clearly identifiable causes, complainants may require prolonged recovery times after leaving the building. (NIOSH)

The term "building related illness" (BRI) is used when symptoms of diagnosable illness are identified and can be attributed directly to airborne building contaminants. Building related illness refers to a defined illness with a known causative agent resulting from exposure to the building air. While the causative agent can be chemical (e.g., formaldehyde), it is often biological. Typical sources of biological contaminants are humidification systems, cooling towers, drain pans or filters, other wet surfaces, or water damaged building material. Symptoms may be specific or mimic symptoms commonly associated with the flu, including fever, chills, and cough. Serious lung and respiratory conditions can occur. Legionnaires' disease, hypersensitivity pneumonitis, and humidifier fever are common examples of building related illness. (EPA)

Indoor Air Quality simply refers to the quality of the air in an office or other building environment. (NIOSH)

Indoor air quality (IAQ) refers to the quality of the air inside buildings as represented by concentrations of pollutants and thermal (temperature and relative humidity) conditions that affect the health, comfort, and performance of occupants. Other factors affecting occupants, such as light and noise, are important indoor environmental quality considerations. (EPA)

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Sick building syndrome (SBS)

- A medical condition in which people in a building suffer from symptoms of illness or feeling unwell for no apparent reason. The symptoms tend to increase in severity with the time people spend in the building, and improve over time or even disappear when people are away from the building. A situation in which occupants of a building experience acute health effects that seem to be linked to time spent in a building, but no specific illness or cause can be identified. The complaints may be localized in a particular room or zone, or may be widespread throughout the building. Frequently, problems result when a building is operated or maintained in a manner that is inconsistent with its original design or prescribed operating procedures. Sometimes indoor air problems are a result of poor building design or occupant activities. (EPA)
- A set of symptoms that affect some members of building occupants during the time they spend in the building and diminish or go away during periods when they leave the building. It can not be traced to specific pollutants or sources within the building. (EPA).
- A term many people use to convey a wide range of symptoms they believe can be attributed to the building itself. Workers typically implicate the workplace environment because their symptoms are alleviated when they leave the office. (NIOSH)

4.0 Prerequisites None. See qualification in Section 7.

5.0 Precautions

Personal Protective Equipment: The use of personal protective equipment to protect personnel when preparing exposure assessment reports is not typically required. The collection of sampling data may expose workers to hazards. Follow all precautions in the corresponding SOP on sampling for specific hazards.

6.0 Procedure

The steps that may be taken in an **initial and in a** large scale IAQ investigation should include the applicable step from the options listed below. Some steps/actions may not be applicable, and it may be appropriate to alter the order of the steps/actions.

Initial Investigation of Small Scale IAQ Concerns

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- 6.1 The SHSD Industrial Hygienist goes to the area of concern for an initial look of the area for obvious problems in the building. The IH reviews the initial compliant or event that has caused the IAQ concern.
- 6.2 The IH notes any indicators of IAQ problems, including odors, building condition, signs of mold or water damage, temperature and humidity conditions, and the presence of hazardous situations or substances. The IH contacts the Building Manager (BM) and ESH Coordinator (ESHC) to determine if the problem(s) in the area have been previously identified and turned into Plant Engineering on a work order for repair. If, not the SME assists the BM and ESHC the preparing the wording to be used on a work order. If the issues have already been submitted via EP work orders, then the IH assists the BM or ESHC in entering an EP Hotline entry at 344-2500.
- 6.3 Rapid analysis sampling may be warranted. Typical sampling includes the building temperature, and humidity on a 24 hour cycle for several days, moisture content of water damages surfaces. Airborne sampling of microbial spores and/or, chemicals, and/or particulates sampling may be indicated by the physical condition of the building and visual assessment.
- 6.4 If needed, the IH meets with Occupants. The meeting will let the occupants know of the preliminary investigation findings, further plans, and to seek their input into the problem and planned actions. The IH will advise Occupants with symptoms to have an OMC medical evaluation.
- 6.5 The IH determines Interim measures (i.e. prompt and immediate actions that can alleviate some of the problems in the area) and long range Remediation/Decontamination.

Large Scale Investigations

- 6.6 Formulate Investigation Team & name a project POC: The POC for the investigative phase is best served by the SHSD Industrial Hygienist. The role of POC can shift to Plant Engineering (EP) or the ESH Coordinator as the project migrates from investigation to remediation of problems in the building.
- 6.7 Team reviews the initial compliant or event that has caused the IAQ concern.

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- 6.8 Team walks the area of concern in a preliminary investigation to get a basic understanding of the structure of the building, physical condition of the structure, occupied areas, processes done in the area, etc. Walk through should include the occupied areas, mechanical rooms, and the exterior of the building. Note any indicators of IAQ, including odors, building condition, signs of mold or water damage, temperature and humidity conditions, and the presence of hazardous situations or substances.
- 6.9 Team creates master timeline for actions & assigns roles: See the tables in Attachment 9.2 for recommendations of the structure and content of the timeline and plan.
- 6.10 Team meets with Occupants. The meeting will let the occupants know of the preliminary investigation findings, further plans, and to seek their input into the problem and planned actions.
- 6.11 Team identifies and documents the Concern /Complaints of the occupants. This will consist of interviews with the occupants of the building and Plant Engineering (EP), the ESH Coordinator, and the Building Manager.
- 6.12 Occupants with symptoms have OMC medical evaluation.
- 6.13 Team characterizes the area of concern via a detailed inspection of the area. Team documents findings on the forms in Attachment 9.2 or an equivalent. Team develops a Sampling Plan, if applicable.
- 6.14 Team determines Initial Actions, including:
- Status of occupancy of the area prior to abatement and sampling
 - PPE for occupants
- 6.15 Sampling is conducted. Typical sampling includes the building temperature, and humidity on a 24 hour cycle for several days, moisture content of water damages surfaces, airborne sampling of microbial spores, chemicals, and/or particulates as indicated by the physical condition of the building and visual assessment. Contaminants that may need to be checked could include:
- Environmental Tobacco Smoke- Lighted cigarettes, cigars, pipes
 - Combustion Contaminants- Furnaces, generators, gas or kerosene space heaters, tobacco products, outdoor air, vehicles.
 - Biological Contaminants- Wet or damp materials, cooling towers, humidifiers, cooling coils or drain pans, damp duct insulation or filters, condensation, re-

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entrained sanitary exhausts, bird droppings, cockroaches or rodents, dust mites on upholstered furniture or carpeting, body odors.

- Volatile Organic Compounds (VOCs)- Paints, stains, varnishes, solvents, pesticides, adhesives, wood preservatives, waxes, polishes, cleansers, lubricants, sealants, dyes, air fresheners, fuels, plastics, copy machines, printers, tobacco products, perfumes, dry cleaned clothing.
- Formaldehyde- Particle board, plywood, cabinetry, furniture, fabrics.
- Soil gases (radon, sewer gas, VOCs, methane)- Soil and rock (radon), sewer drain leak, dry drain traps, leaking underground storage tanks, land fill
- Pesticides- Termiticides, insecticides, rodenticides, fungicides, disinfectants, herbicides.
- Particles and Fibers- Printing, paper handling, smoking and other combustion, outdoor sources, deterioration of materials, construction/renovation, vacuuming, and insulation.

- 6.16 Team determines Interim measures i.e. prompt and immediate actions that can alleviate some of the problems in the area and the schedule for balance of action. Refer to Attachment 9.1 for guidance on possible causes and possible remediation actions.

The team contacts the Building Manager (BM) and ESH Coordinator (ESHC) to determine if the actions needed to correct problem(s) in the area have been previously identified and turned into Plant Engineering on a work order. If, not the team assists the BM and ESHC the preparing the wording to be used on a work order. If the issues have already been submitted via EP work orders, then the team assists the BM or ESHC in entering an EP Hotline entry at 344-2500.

- 6.17 Team develops Remediation/Decontamination Plan, if applicable, including:

- Pre and Post clearance criteria
- PPE for abatement crew
- Cleaning Technique
- Protection of adjacent areas, such as use of portable HEPA units

The team contacts the Building Manager (BM) and ESH Coordinator (ESHC) to determine if the actions needed to correct problem(s) in the area have been previously identified and turned into Plant Engineering on a work order. If, not the team assists the BM and ESHC the preparing the wording to be used on a work order. If the issues have already been submitted via EP work orders, then the team assists the BM or ESHC in entering an EP Hotline entry at 344-2500.

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6.18 Remediation/Decontamination Commences

6.19 Team determines the Post Abatement analysis status of the building and determines the fitness for re-occupancy, if the area was vacated for sampling or decontamination. Additional sampling may be needed for this analysis.

6.20 Team meets with occupants to describe the investigation, sampling, remediation, and final status of the building.

6.21 **Preparation of a formal report on the exposure monitoring or hazard assessment.** The *IH Professional* will ensure the preparation of a summary report of the exposure monitoring or hazard assessment that contains, at a minimum, the contents specified in IH60500 **Attachment 9.32 Report Content Requirements**.

6.22 **Maintaining Documentation:** The *IH Professional* is to maintain documentation for all personnel samples collected at BNL in the following manner:

- The original of laboratory analysis reports, exhibits, photos, sketches, sampling sheets, etc is to be provided to the SHSD IHG *Exposure Monitoring Record Custodian*. The SHSD IHG *Exposure Monitoring Record Custodian* will issue a unique filing number to the sample documentation.
- The original of final assessment reports is to be provided to the SHSD IHG *Document & Record Custodian*.
- The *Sampler* and *IH Professional* may keep unofficial copies of the files for personal reference. These are to be marked "COPY".
- Store electronic versions of sampling forms and formal reports on the SHSD Shared Drive

6.23 **Distribute a summary of the exposure results and assessment report to OMC** that provides the following data: Name(s) and BNL# of employee(s) represented by the monitoring, the TWA-8 results, and the ACGIH and OSHA occupational exposure limit value.

6.24 **Distribution of Copies to Responsible Individuals:** For all personal exposure monitoring hazard analyses, the formal report is to be distributed to:

- Affected employees (personnel monitored and those represented by the monitored employees)
- Line supervisor of employees
- IH Group Record Custodian (original),
- Facility Support Representative,
- ESH coordinator and

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- Any other responsible party requesting a copy as authorized by OSHA or DOE regulations.

7.0 Implementation and Training

Qualification Criteria: Only individuals who have knowledge of this procedure and extensive experience in IH hazard assessments or certification in industrial hygiene will be qualified to perform the assessments described in this procedure. Qualification criteria for any organization using this SOP:

- 7.1 All work under this SOP shall be performed by persons who have demonstrated the competence to satisfactorily perform the tests as evidenced by experience and training to meet the qualification criteria set in *IH50300 BNL IH Program and IH Group Training & Qualification Matrix*. The qualification of personnel is to be by a method approved by the BNL IH Program Manager from SHSD.
- 7.2 BNL Training & Qualification Program on Principle of planning, sampling and reporting on IH hazard assessments: Personnel are to meet the performance measures set forth in *Attachment 9.3 JPM Qualification*. This qualification is to be completed on a three year cycle.

8.0 References

- 8.1 "Indoor Air Facts No. 4 (revised): Sick Building Syndrome (SBS)" Office of Air and Radiation; US EPA Office of Radiation and Indoor Air (6609J), EPA 402-F-94-004, April 1991.
- 8.2 NIOSH, [Building Air Quality Action Plan](#), DHHS (NIOSH) Publication No. 98-123 (June 1998).
- 8.3 ASHRAE 62, Ventilation for Indoor Air Quality.
- 8.4 EPA: Indoor Air Quality Building Education and Assessment Guidance (I-BEAM).

9.0 Attachments

- 9.1 EPA Causes and Solutions for Sick Building
- 9.2 BNL Checklists for IAQ Investigations
- 9.3 *Job Performance Measure*

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10.0 Documentation

Document Development and Revision Control Tracking		
PREPARED BY: <i>(signature and date on file)</i> R. Selvey Date: 04/21/06	REVIEWED BY: <i>(signature and date on file)</i> J. Peters Date: 04/24/06	APPROVED BY: <i>(signature and date on file)</i> R. Selvey; IH Group Leader Date: 04/25/06
ESH Coordinator/ Date: <i>none</i>	Work Coordinator/ Date: <i>none</i>	SHSD Manager / Date <i>none</i>
QA Representative / Date: <i>none</i>	Training Coordinator / Date: <i>none</i>	Filing Code: IH52
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ISM Review - Hazard Categorization <input type="checkbox"/> High <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Low/Skill of the craft	Validation: <input type="checkbox"/> Formal Walkthrough <input type="checkbox"/> Desk Top Review <input checked="" type="checkbox"/> SME Review Name / Date:	IMPLEMENTATION: Training Completed: tracked in BTMS Procedure posted on Web: 04/25/06 Hard Copy files updated: 04/25/06

Revision Log		
Purpose: <input type="checkbox"/> Temporary Change <input type="checkbox"/> Change in Scope <input type="checkbox"/> Periodic review <input checked="" type="checkbox"/> Clarify/enhance procedural controls		
Changed resulting from: <input type="checkbox"/> Environmental impacts <input type="checkbox"/> Federal, State and/or Local requirements <input type="checkbox"/> Corrective/preventive actions to non-conformances <input checked="" type="checkbox"/> none of the above		
Section/page and Description of change: After meeting with Plant Engineering on the mechanics of IAQ investigations and the interactions of SHSAD and EP, Section 6 of the procedure was split into "small scale" and large scale" investigation to better reflect the actual occurrences of IAQ investigations at BNL. Step 6.1 to 6.5 were inserted. The addition of the EP Hotline x-2500 was added to section 6.		
<i>(signature and date on file)</i> R. Selvey 06/26/06 SME Reviewer/Date:	Reviewer/Date:	Reviewer/Date:

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Attachment 9.1

EPA Guidance on the Causes and Solutions of Sick Building Syndrome

The following have been cited causes of or contributing factors to sick building syndrome:

1. **Inadequate ventilation:** In the early and mid 1900's, building ventilation standards called for approximately 15 cubic feet per minute (cfm) of outside air for each building occupant, primarily to dilute and remove body odors. As a result of the 1973 oil embargo, however, national energy conservation measures called for a reduction in the amount of outdoor air provided for ventilation to 5 cfm per occupant. In many cases these reduced outdoor air ventilation rates were found to be inadequate to maintain the health and comfort of building occupants. Inadequate ventilation, which may also occur if heating, ventilating, and air conditioning (HVAC) systems do not effectively distribute air to people in the building, is thought to be an important factor in SBS. In an effort to achieve acceptable IAQ while minimizing energy consumption, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) recently revised its ventilation standard to provide a minimum of 15 cfm of outdoor air per person (20 cfm/person in office spaces). Up to 60 cfm/person may be required in some spaces (such as smoking lounges) depending on the activities that normally occur in that space (see ASHRAE Standard 62).
2. **Chemical contaminants from indoor sources:** Most indoor air pollution comes from sources inside the building. For example, adhesives, carpeting, upholstery, manufactured wood products, copy machines, pesticides, and cleaning agents may emit volatile organic compounds (VOCs), including formaldehyde. Environmental tobacco smoke contributes high levels of VOCs, other toxic compounds, and respirable particulate matter. Research shows that some VOCs can cause chronic and acute health effects at high concentrations, and some are known carcinogens. Low to moderate levels of multiple VOCs may also produce acute reactions. Combustion products such as carbon monoxide, nitrogen dioxide, as well as respirable particles, can come from unvented kerosene and gas space heaters, woodstoves, fireplaces and gas stoves.
3. **Chemical contaminants from outdoor sources:** The outdoor air that enters a building can be a source of indoor air pollution. For example, pollutants from motor vehicle exhausts; plumbing vents, and building exhausts (e.g., bathrooms and kitchens) can enter the building through poorly located air intake vents, windows, and other openings. In addition, combustion products can enter a building from a nearby garage.
4. **Biological contaminants:** Bacteria, molds, pollen, and viruses are types of biological contaminants. These contaminants may breed in stagnant water that has accumulated in ducts, humidifiers and drain pans, or where water has collected on ceiling tiles, carpeting, or insulation. Sometimes insects or bird droppings can be a source of biological contaminants. Physical symptoms related to biological contamination include cough, chest tightness, fever, chills, muscle aches, and allergic responses such as mucous membrane irritation and upper respiratory congestion. One indoor bacterium, *Legionella*, has caused both Legionnaire's Disease and Pontiac Fever.

These elements may act in combination, and may supplement other complaints such as inadequate temperature, humidity, or lighting. Even after a building investigation, however, the specific causes of the complaints may remain unknown.

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Indoor Pollutants and Potential Source

Pollutant or Pollutant Class	Potential Sources
Environmental Tobacco Smoke	Lighted cigarettes, cigars, pipes
Combustion Contaminants	Furnaces, generators, gas or kerosene space heaters, tobacco products, outdoor air, vehicles.
Biological Contaminants	Wet or damp materials, cooling towers, humidifiers, cooling coils or drain pans, damp duct insulation or filters, condensation, re-entrained sanitary exhausts, bird droppings, cockroaches or rodents, dust mites on upholstered furniture or carpeting, body odors.
Volatile Organic Compounds (VOCs)	Paints, stains, varnishes, solvents, pesticides, adhesives, wood preservatives, waxes, polishes, cleansers, lubricants, sealants, dyes, air fresheners, fuels, plastics, copy machines, printers, tobacco products, perfumes, dry cleaned clothing.
Formaldehyde	Particle board, plywood, cabinetry, furniture, fabrics.
Soil gases (radon, sewer gas, VOCs, methane)	Soil and rock (radon), sewer drain leak, dry drain traps, leaking underground storage tanks, land fill
Pesticides	Termiticides, insecticides, rodenticides, fungicides, disinfectants, herbicides.
Particles and Fibers	Printing, paper handling, smoking and other combustion, outdoor sources, deterioration of materials, construction/renovation, vacuuming, insulation.

Solutions usually include combinations of the following:

1. **Pollutant source removal or modification** is an effective approach to resolving an IAQ problem when sources are known and control is feasible. Examples include routine maintenance of HVAC systems, e.g., periodic cleaning or replacement of filters; replacement of water-stained ceiling tile and carpeting; institution of smoking restrictions; venting contaminant source emissions to the outdoors; storage and use of paints, adhesives, solvents, and pesticides in well ventilated areas, and use of these pollutant sources during periods of non-occupancy; and allowing time for building materials in new or remodeled areas to off-gas pollutants before occupancy. Several of these options may be exercised at one time.
2. **Increasing ventilation rates** and air distribution often can be a cost effective means of reducing indoor pollutant levels. HVAC systems should be designed, at a minimum, to meet ventilation standards in local building codes; however, many systems are not operated or maintained to ensure that these design ventilation rates are provided. In many buildings, IAQ can be improved by operating the HVAC system to at least its design standard, and to ASHRAE Standard 62 if possible. When there are strong pollutant sources, local exhaust ventilation may be appropriate to exhaust contaminated air directly from the building. Local exhaust ventilation is particularly recommended to remove pollutants that accumulate in specific areas such as rest rooms, copy rooms, and printing facilities.

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3. **Air cleaning** can be a useful adjunct to source control and ventilation but has certain limitations. Particle control devices such as the typical furnace filter are inexpensive but do not effectively capture small particles; high performance air filters capture the smaller, respirable particles but are relatively expensive to install and operate. Mechanical filters do not remove gaseous pollutants. Some specific gaseous pollutants may be removed by adsorbent beds, but these devices can be expensive and require frequent replacement of the adsorbent material. In sum, air cleaners can be useful, but have limited application.
4. **Education and communication** are important elements in both remedial and preventive indoor air quality management programs. When building occupants, management, and maintenance personnel fully communicate and understand the causes and consequences of IAQ problems, they can work more effectively together to prevent problems from occurring, or to solve them if they do.

The following table identifies sources of contaminants commonly found in office buildings and offers some measures for maintaining control of these contaminants. Follow these measures to help maintain a healthy indoor environment.

Table 1.2 Indoor Sources and Tips for Mitigation

Category/Common Sources	Tips for Mitigation and Control
Housekeeping and Maintenance <ul style="list-style-type: none"> • cleansers • waxes and polishes • disinfectants • air fresheners • adhesives • janitor's/storage closets • wet mops • drain cleaners • vacuuming • paints and coatings • solvents • pesticides • lubricants 	<ul style="list-style-type: none"> • Use low-emitting products • Avoid aerosols and sprays • Dilute to proper strength (manufacturer's instructions) • Do not overuse; use during unoccupied hours • Use proper protocol when diluting and mixing • Store properly with containers closed and lid tight • Use exhaust ventilation for storage spaces (eliminate return air) • Clean mops: store mop top up to dry • Avoid "air fresheners"—clean and exhaust instead • Use high efficiency vacuum bags/filters • Use Integrated Pest Management
Occupant-Related Sources <ul style="list-style-type: none"> • Tobacco products • Office equipment <ul style="list-style-type: none"> ○ Printers ○ copiers • cooking/microwave • art supplies • marking pens • paper products • personal products (e.g., perfume) • tracked in dirt/pollen 	<ul style="list-style-type: none"> • Smoking policy • Use exhaust ventilation with pressure control for major local sources • Low emitting art supplies/marketing pens • Avoid paper clutter • Education material for occupants and staff

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Building Uses as Major Sources <ul style="list-style-type: none"> • print/photocopy shop • science laboratory • medical office • cafeteria 	<ul style="list-style-type: none"> • Use exhaust ventilation and pressure control • Use exhaust hoods where appropriate; check hood airflows
Building-Related Sources <ul style="list-style-type: none"> • plywood/compressed wood • construction adhesives • asbestos products • insulation • wall/ floor coverings (vinyl/plastic) • carpets/carpet adhesives • wet building products • transformers • upholstered furniture • renovation/remodeling 	<ul style="list-style-type: none"> • Use low emitting products • Air out in an open/ventilated area before installing • Increase ventilation rates during and after installing • Keep material dry prior to enclosing • Use renovation guidelines
HVAC system <ul style="list-style-type: none"> • contaminated filters • contaminated duct lining • dirty drain pans • humidifiers • lubricants • refrigerants • mechanical room • maintenance activities • combustion appliances <ul style="list-style-type: none"> ▪ boilers/furnaces ▪ DHW ▪ generators ▪ stoves 	<ul style="list-style-type: none"> • Perform HVAC preventive maintenance • Use filter change protocol • Clean drain pans; proper slope and drainage • Use potable water for steam humidification • Keep duct lining dry; move lining outside of duct if possible • Fix leaks/clean spills (see filter change protocol) • Maintain spotless mechanical room (not a storage area) • Avoid back drafting • Check/maintain flues from boiler to outside • Keep combustion appliances properly tuned • Disallow unvented combustion appliances • Perform polluting activities during unoccupied hours
Moisture <ul style="list-style-type: none"> • Mold 	<ul style="list-style-type: none"> • Keep building dry • Mold and Moisture Control Protocol
Vehicles <ul style="list-style-type: none"> • Underground/attached garage 	<ul style="list-style-type: none"> • Use exhaust ventilation • Maintain garage under negative pressure relative to the building • Check air flow patterns frequently • Monitor CO

Outdoor Sources

The following table identifies common sources of contaminants that are introduced from outside buildings. These contaminants frequently find their way inside through the building shell, openings, or other pathways to the inside.

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Outdoor Sources and Tips for Mitigation

Category/Common Sources	Tips for Mitigation and Control
Ambient Outdoor Air <ul style="list-style-type: none"> air quality in the general area 	<ul style="list-style-type: none"> Filtration or air cleaning of intake air
Vehicular Sources <ul style="list-style-type: none"> local vehicular traffic vehicle idling areas loading dock 	<ul style="list-style-type: none"> Locate air intake away from source Require engines shut off at loading dock Pressurize building/zone Add vestibules/sealed doors near source
Commercial/Manufacturing Sources <ul style="list-style-type: none"> laundry or dry cleaning restaurant photo-processing automotive shop/gas station paint shop electronics manufacture/assembly various industrial operations 	<ul style="list-style-type: none"> Locate air intake away from source Pressurize building relative to outdoors Consider air cleaning options for outdoor air intake Use landscaping to block or redirect flow of contaminants, but not too close to air intakes
Utilities/Public Works <ul style="list-style-type: none"> utility power plant incinerator water treatment plant 	
Agricultural <ul style="list-style-type: none"> pesticide spraying processing or packing plants ponds 	
Construction/Demolition	<ul style="list-style-type: none"> Pressurize building Use walk-off mats
Building Exhaust <ul style="list-style-type: none"> bathrooms exhaust restaurant exhaust air handler relief vent exhaust from major tenant (e.g., dry cleaner) 	<ul style="list-style-type: none"> Separate exhaust or relief from air intake Pressurize building
Water Sources <ul style="list-style-type: none"> pools of water on roof cooling tower mist 	<ul style="list-style-type: none"> Proper roof drainage Separate air intake from source of water Treat and maintain cooling tower water
Birds and Rodents <ul style="list-style-type: none"> fecal contaminants bird nesting 	<ul style="list-style-type: none"> Bird proof intake grills Consider vertical grills Use Integrated Pest Management
Building Operations and Maintenance	<ul style="list-style-type: none"> Separate source from air intake

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<ul style="list-style-type: none"> trash and refuse area chemical/fertilizers/grounds keeping storage painting/roofing/sanding 	<ul style="list-style-type: none"> Keep source area clean/lids on tight Isolate storage area from occupied areas
Ground Sources <ul style="list-style-type: none"> soil gas sewer gas underground fuel storage tanks 	<ul style="list-style-type: none"> Depressurize soil Seal foundation and penetrations to foundation Keep air ducts away from ground sources
Painting	<ul style="list-style-type: none"> Establish a protocol for painting and insure that the protocol is followed by both in-house personnel and by contractors. <ul style="list-style-type: none"> Use low VOC emission, fast drying paints where feasible. Paint during unoccupied hours. Keep lids on paint containers when not in use. Ventilate the building with significant quantities of outside air during and after painting. Insure a complete building flush prior to occupancy. Use more than normal outside air ventilation for some period after occupancy. Avoid spraying, when possible.
Shipping and Receiving	<ul style="list-style-type: none"> Establish and enforce a program to prevent vehicle contaminants from entering the building. <ul style="list-style-type: none"> Do not allow idling of vehicles at the loading dock. Post signs and enforce the ban. Pressurize the receiving area relative to the outside to insure that contaminants from the loading area do not enter the building. Use pressurized vestibules and air locks if necessary. Periodically check the pressure relationships and compliance with the protocol. Notify delivery company supervisors of policy.
Managing Moisture and Mold	<p>Mold thrives in the presence of water. The secret to controlling mold is to control moisture and relative humidity</p> <ul style="list-style-type: none"> Keep relative humidity below 60% (50%, if feasible, to control dust mites) <p>Keep all parts of the building dry that are not designed to be wet</p> <ul style="list-style-type: none"> Adequately insulate exterior walls or ceilings to avoid condensation on cold surfaces Insulate cold water pipes to avoid sweating Clean spills immediately. Thoroughly clean and dry liquid spills on porous surfaces such as carpet within 24 hours, or discard the material Do not allow standing water in any location

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	<ul style="list-style-type: none">• Maintain proper water drainage around the perimeter of the building• Provide sufficient exhaust in showers or kitchen areas producing steam <p>Thoroughly clean areas that are designed to be wet</p> <ul style="list-style-type: none">• Wash floors and walls often where water accumulates (e.g., showers)• Clean drain pans often and insure a proper slope to keep water draining• Insure proper maintenance and treatment of cooling tower operations <p>Discard all material with signs of mold growth</p> <ul style="list-style-type: none">• Discard furniture, carpet, or similar porous material having a persistent musty odor• Discard furniture, carpet, or similar porous material that has been wet for more than 24 hours• Discard ceiling tiles with visible water stains
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Attachment 9.2

BNL Checklists for IAQ Investigations

(See next pages)

Record 1: Investigation Initiation

Description of Problem:	
Bldg:	Room(s):
Start of Incident (Date):	Investigation Start Date:

Description of the Area

Current Use of Area:
What is involved in current operations (chemicals, machinery, tools, etc)
Previous Uses of Area

Investigation Team (not all these parties are necessary for every investigation)

Date team assembled:	
Project Manager:	
ESH Coordinator	
Area Occupant Representative	
Building Manager	
Plant Engineering Representative	
SHSD- IH Service Representative	
OMC	
Line Mgmt: PI or Supervisor	
Other:	
Other:	

Record 2: Project Plan Time Line

Date of Plan Creation:	
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Action (not all step may be applicable)	Responsible Party	Additional Team Members	Due Date	Completed
2.1. Meet with Affected Individuals (Record 4)				
2.2. Conduct Initial Characterization of Area (Record 3)				
2.3. OMC Evaluate Affected Individuals				
2.4. Conduct Building & Bldg. Material Examination (Record 3)				
2.5. Create Initial Action Plan (Record 2)				
2.6. Institute quick fixes (such as filter changes, area cleaning, AC servicing) (Record 7)				
2.7. Sampling Plan (Record 6)				
2.8. Sampling Analysis				
2.9. Evaluation of sampling data and characterizations				
2.10. Prepare Communication Plan with Occupants on Project Status				
2.11. Develop Interim Occupancy Strategy (Record 7)				
2.12. Develop Abatement Strategy (Record 7)				
2.13. Conduct Pre-abatement testing (Record 7)				
2.14. Abate Hazards (Record 7)				
2.15. Evaluate Abatement Success (Record 7)				
2.16. Clear Area for Re-occupancy (Record 7)				

Indoor Air Quality

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Attachment 9.2

Action (not all step may be applicable)	Responsible Party	Additional Team Members	Due Date	Completed
2.17. Other:				
2.18. Other:				

Record 3: Characterization of Area

Building		Date
Room		

Team members(s)		

Parameter	Description of Condition
Occupancy	
Floor plan	
HVAC	
Air Intakes to Building	
Thermostat setting	
Air balance (+) or (-)	
Flooring	
Furniture	
Ceiling	
Wall Coverings	
Room Contents:	Plants
	Books
	Paper
	Equipment
Visual damage	___ Water Damage ___ Mold/Mildew ___ Signs of Animals
Recent Changes to the Area	
Previous Documentation	
Operations in Adjacent Areas with potential to enter Area of Concern	

Record 4a: Meeting with Occupants

Date:		
Names of Affected Persons/ Occupants	#	Name
	1	
	2	
	3	
	4	
Investigation Team Member(s)		

Parameter	Employee #			
	1	2	3	4
Symptoms				
Time symptoms first occurred				
Time of re-occurring symptoms				
Frequency of symptoms				
Area of occupancy				
Unusual events associated with problem				
Initiating Event				
Suspected Triggers				
Recent Changes to the Area				
Occupants' Primary Concern				

Record 5: IAQ Complaint Form

Date:	Name:	
Department/Location in Building	Title:	Phone:

This form can be used if your complaint is related to indoor air quality. Indoor Air Quality problems include concerns with temperature control, ventilation, and air pollutants. Your observations can help resolve the problem as quickly as possible. Please use the space below to describe the nature of the complaint and any potential causes.

We may need to contact you to discuss your complaint. What is the best time to reach you?

So that we can respond promptly, please return this form to: IAQ Manager SHSD Bldg 120

Official Use only:		
File#	Received B	Date Received

Record 6: Sampling Plan

Action	Responsible Party	Due Date Sampling	Expected date results	Project Costs	Project # Activity #
<input type="checkbox"/> Microbes					
<input type="checkbox"/> Tape Lifts					
<input type="checkbox"/> Viable Spores Impaction					
<input type="checkbox"/> Bulk					
<input type="checkbox"/> Aer-o-cel					
<input type="checkbox"/> Particulate					
<input type="checkbox"/> Respirable Gravimetric					
<input type="checkbox"/> Respirable					
<input type="checkbox"/> Total Dust- Gravimetric					
<input type="checkbox"/> Dust- PCM					
<input type="checkbox"/> Total Dust- AA/ ICP					
<input type="checkbox"/> Fiberglass					
<input type="checkbox"/> Asbestos					
<input type="checkbox"/> Organics					
<input type="checkbox"/> VOCs- Sorbent tube- GC/MS					
<input type="checkbox"/> VOC- sorbent- Analyte:					
<input type="checkbox"/> VOC- minican- GC/MS					
<input type="checkbox"/> Physical Parameters					
<input type="checkbox"/> RH/Temp log				n/a	n/a
<input type="checkbox"/> Delta P				n/a	n/a
<input type="checkbox"/> Ventilation Flow Rate				n/a	n/a
<input type="checkbox"/> Moisture Content				n/a	n/a
<input type="checkbox"/> Lighting				n/a	n/a
<input type="checkbox"/> EMFs				n/a	n/a
<input type="checkbox"/> Other					

Record 7: Initial and Interim Actions & Decon Plan

Initial Actions

Team Members:	
Date of Recommendations	
Effective Dates for Recommendations	

Action	Recommendation	Responsible Party	Due Date
7.1. Actions prior to abatement for occupants			
7.2. PPE for occupants			
7.3. Interim protective equipment (such as Portable HEPA units)			
7.4. Actions prior to abatement for occupants			
7.5. PPE for occupants			
7.6. Interim protective equipment (such as Portable HEPA units)			
7.7. PPE or protective equipment for interim work crew			
7.8. Other precautions			

Decontamination or Remediation Actions

Team Members:	
Date of Recommendations	
Effective Dates for Recommendations	

Action	Recommendation	Responsible Party	Due Date
7.9. Establish Pre and Post			

clearance criteria			
7.10. Sample for Pre Project Criteria			
7.11. Actions during abatement for occupants			
7.12. PPE for occupants			
7.13. PPE for abatement crew			
7.14. Protective equipment for area such as portable HEPA units			
7.15. Determine Clean Up Techniques			
7.16. Clean area per techniques			
7.17. Post cleaning inspection			
7.18. Measure Post clearance criteria			
7.19. Post Decon Analysis & Final report			
7.20. Evaluate re-occupancy			
7.21. Critique and Lessons Learned			

Indoor Air Quality

Hazard Assessment and Investigator Job Performance Measure (JPM) Completion Certificate

Candidate's Name	Life Number:	Qualification Number: HP-IHP- 97000
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Practical Skill Evaluation: Demonstration of Evaluation Methodology by Oral Exam

Criteria	Qualifying Performance Standard	Unsat.	Recov.	Satisf.
1. Determining the need for investigation	Demonstrates knowledge in responding to line management or other indicators of the need to perform a hazard assessment.			
2. Lead investigation team	Has the leadership abilities to lead an investigation team and ensure that corrective actions are directed through BNL organizations with the financial responsibilities and authority to authorize expenses.			
3. Conducts appropriate interviews	Demonstrates knowledge in setting up and conducting interviews with supervision and workers to determine exposure characteristics.			
4. Conducts hazard assessment	Demonstrates knowledge in setting up and conducting appropriate area surveys to determine exposure potential in the work operations.			
5. Sampling Equipment	Knows where equipment needed for the procedure is located and how to properly sign it out.			
6. Measurement of hazard	Knows how to properly measure employee exposure to Indoor Air Quality contaminant levels.			
7. Documentation	Demonstrates correctly filling out IH forms, transfers appropriate info to IH databases, prepares an evaluation assessment report (including an evaluation of the relationship of the exposure to occupational exposure limits), and notify workers and management of the results.			

I accept the responsibility for performing this task as demonstrated within this JPM and the corresponding SOP.

Candidate Signature:	Date:
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I certify the candidate has satisfactorily performed each of the above listed steps and is capable of performing the task unsupervised.

Evaluator Signature:	Date:
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